

## Claims

1. A method of making a tantalum structure, comprising creating a tantalum layer disposed on a first layer region of a first layer and on a second layer region of a second layer, wherein said tantalum layer is a substantially bcc-phase tantalum region on said first layer region and said tantalum layer is a non-bcc-phase tantalum region on said second layer region.

2. The method in accordance with claim 1, wherein creating said tantalum layer further comprises:  
creating said substantially bcc-phase tantalum region having a compressive residual stress; and

creating said non-bcc-phase tantalum region having a compressive residual stress.

3. The method in accordance with claim 1, wherein creating said tantalum layer further comprises creating substantially bcc-phase tantalum region in contact with said non-bcc-phase tantalum region.

4. The method in accordance with claim 1, wherein creating said tantalum layer further comprises creating said tantalum layer wherein said substantially bcc-phase tantalum region and said non-bcc-phase tantalum region form an essentially contiguous tantalum film.

5. The method in accordance with claim 1, further comprising:  
forming said first layer region over a first portion of a substrate; and  
forming said second layer region over a second portion of said substrate.

6. The method in accordance with claim 5, wherein forming said first layer region further comprises forming a bcc-phase-tantalum forming region disposed over said substrate.

7. An apparatus manufactured in accordance with claim 6.

8. The method in accordance with claim 1, further comprising creating said first layer.

9. The method in accordance with claim 8, wherein creating said first layer further comprises creating a bcc-phase-tantalum forming first layer.

10. The method in accordance with claim 9, wherein creating said bcc-phase-tantalum forming first layer further comprises sputter depositing or chemically vapor depositing said bcc-phase-tantalum forming first layer.

11. The method in accordance with claim 9, wherein creating said bcc-phase-tantalum forming first layer further comprises creating said bcc tantalum forming first layer utilizing a material selected from the group consisting of niobium, aluminum, titanium, tantalum nitride, aluminum nitride, niobium nitride, titanium nitride, and mixtures thereof.

12. The method in accordance with claim 9, wherein creating said bcc-phase-tantalum forming first layer further comprises creating said bcc-phase-tantalum forming first layer disposed on a sacrificial layer.

13. The method in accordance with claim 12, further comprising:  
removing said sacrificial layer; and  
forming a free standing tantalum film having bcc-phase tantalum regions and non-bcc-phase tantalum regions.

14. The method in accordance with claim 9, wherein creating said bcc-phase-tantalum forming first layer further comprises creating a monolayer bcc-phase-tantalum forming first layer.

15. The method in accordance with claim 9, wherein creating said bcc-phase-tantalum forming first layer further comprises depositing said bcc-phase-tantalum forming first layer utilizing a deposition technique selected from the group consisting of sputtering, laser ablation, electron beam evaporation, thermal evaporation, electro-deposition, electroless deposition, chemical vapor deposition, and combinations thereof.

16. The method in accordance with claim 8, wherein creating said first layer further comprises creating a bcc-phase-tantalum forming substrate, wherein said second layer is disposed over said bcc-phase-tantalum forming substrate.

17. The method in accordance with claim 16, further comprising depositing said second layer over said bcc-phase-tantalum forming substrate.

18. The method in accordance with claim 17, further comprising:  
patterning said second layer; and  
forming openings in said second layer exposing regions of said bcc-phase-tantalum forming substrate.

19. The method in accordance with claim 1, further comprising creating said second layer, wherein said second layer is a substrate.

20. The method in accordance with claim 19, further comprising creating said first layer over said substrate.

21. The method in accordance with claim 1, further comprising etching said tantalum layer.

22. The method in accordance with claim 22, wherein etching said tantalum layer further comprises selectively etching said non-bcc-phase tantalum region.

23. The method in accordance with claim 22, wherein selectively etching said non-bcc-phase tantalum region further comprises selectively etching said non-bcc-phase tantalum region without a mask.

24. The method in accordance with claim 21, further comprising etching said tantalum layer utilizing a chlorine reactive ion plasma etch to selectively etch said non-bcc-phase tantalum region.

25. The method in accordance with claim 1, wherein creating said tantalum layer further comprises applying a voltage bias to said first layer.

26. The method in accordance with claim 25, wherein applying said voltage bias comprises applying a voltage bias less than about 550 volts.

27. The method in accordance with claim 1, wherein creating said tantalum layer further comprises creating said tantalum layer wherein said substantially bcc-phase tantalum region has a resistivity of about 13 micro-ohm centimeters, and wherein said non-bcc-phase tantalum region has a resistivity of about 220 micro-ohm centimeters.

28. The method in accordance with claim 1, wherein creating said tantalum layer further comprises creating said tantalum layer wherein said substantially bcc-phase tantalum region and said non-bcc-phase tantalum region each has a resistivity and said resistivity of said substantially bcc-phase tantalum region is about 10 times less than said resistivity of said non-bcc-phase tantalum region.

29. The method in accordance with claim 1, further comprising cleaning said first layer region before creating said tantalum layer.

30. The method in accordance with claim 29, wherein cleaning said first layer region further comprises wet chemically cleaning said first layer region.

31. The method in accordance with claim 29, wherein cleaning said first layer region further comprises sputter cleaning said first layer region.

32. The method in accordance with claim 31, wherein sputter pre-cleaning further comprises sputter cleaning said first layer region utilizing an inert gas.

33. The method in accordance with claim 32, wherein sputter pre-cleaning further comprises sputter cleaning said first layer region utilizing a halogen gas.

34. The method in accordance with claim 1, further comprising creating said second layer.

35. The method in accordance with claim 34, wherein creating said second layer further comprises creating a dielectric layer disposed between a substrate and said first layer.

36. The method in accordance with claim 35, wherein creating said dielectric layer further comprises:

creating a silicon carbide layer disposed between said substrate and said first layer; and

creating a silicon nitride layer disposed between said substrate and said silicon carbide layer.

37. The method in accordance with claim 1, further comprising creating a resistor layer disposed between a substrate and said first layer.

38. The method in accordance with claim 37, wherein creating said resistor layer further comprises creating said resistor layer having a material selected from the group consisting of tantalum aluminum alloys, polycrystalline silicon, tungsten silicon nitride, and mixtures thereof.

39. The method in accordance with claim 37, further comprising creating an electrical conductor electrically coupled to said resistor layer.

40. The method in accordance with claim 1, further comprising creating a chamber layer disposed over said tantalum layer.

41. The method in accordance with claim 40, further comprising forming a fluid ejection chamber in said chamber layer.

42. The method in accordance with claim 40, further comprising creating a nozzle layer disposed over said chamber layer.

43. The method in accordance with claim 42, further comprising forming at least one nozzle in fluid communication with a fluid ejection chamber formed in said chamber layer.

44. An apparatus manufactured in accordance with claim 1.
45. A fluid ejector head manufactured in accordance with claim 1.
46. The method in accordance with claim 1, further comprising:  
creating said first layer wherein said first layer is a bcc-phase-tantalum forming substrate; and  
depositing a non-bcc-phase-tantalum forming layer on said bcc-phase-tantalum forming substrate.
47. The method in accordance with claim 46, further comprising:  
patterning said non-bcc-phase-tantalum forming layer; and  
creating openings to said bcc-phase-tantalum forming substrate.
48. The method in accordance with claim 46, wherein said bcc-phase-tantalum forming substrate includes a material selected from the group consisting of niobium, aluminum, titanium, tantalum nitride, aluminum nitride, niobium nitride, titanium nitride, and mixtures thereof.
49. An apparatus, comprising a tantalum layer having a substantially bcc-phase tantalum region contiguous to a non-bcc-phase tantalum region, wherein said substantially bcc-phase tantalum region and said non-bcc-phase tantalum region each have a compressive residual stress.

50. An apparatus, comprising:  
a substrate;  
a tantalum layer disposed over said substrate; and  
a bcc-phase-tantalum forming region disposed between said substrate and said tantalum layer, said bcc-phase-tantalum forming region in contact with said tantalum layer, wherein said tantalum layer forms a substantially bcc-phase tantalum region where said tantalum layer is in contact with said bcc-phase-tantalum forming region.

51. The apparatus in accordance with claim 50, wherein said tantalum layer forms a non-bcc-phase tantalum layer where said tantalum layer is not in contact with said bcc-phase-tantalum forming region.

52. The apparatus in accordance with claim 51, further comprising:  
a silicon oxide layer disposed on said substrate;  
a resistive layer disposed on said silicon oxide layer; and  
a first dielectric layer disposed over said resistive layer, said seed layer disposed on a portion of said first dielectric layer, and said tantalum layer disposed on said dielectric layer and said seed layer, wherein said non-bcc-phase tantalum layer is formed on said dielectric layer and said substantially bcc-phase tantalum layer is formed on said seed layer.

53. The apparatus in accordance with claim 50, further comprising:  
a chamber layer disposed on said tantalum layer, said chamber layer having at least a portion of a chamber formed therein; and  
a nozzle layer disposed on said chamber layer, said nozzle layer having at least one nozzle formed therein and in fluid communication with said chamber.



54. An apparatus, comprising:

a substrate; and

means for creating a tantalum layer disposed over or on said substrate, said tantalum layer having at least one substantially bcc-phase tantalum region contiguous with at least one non-bcc-phase tantalum region.

55. The apparatus in accordance with claim 54, further comprising means for selectively removing a sacrificial layer forming a self-supporting tantalum layer.

56. The apparatus in accordance with claim 54, further comprising means for selectively etching said at least one non-bcc-phase tantalum region.